

P R O J E C T facts

DEPARTMENT OF ENERGY
OFFICE OF FOSSIL ENERGY

CLEAN coal
TECHNOLOGY

PUBLIC SERVICE COMPANY OF COLORADO—COMBINING CLEAN COAL TECHNOLOGIES TO IMPROVE AIR QUALITY

PRIMARY PROJECT PARTNER

**Public Service Company
of Colorado**
Denver, CO

MAIN SITE

Arapahoe Station
Denver, CO

TOTAL ESTIMATED COST

\$27,400,000

COST SHARING

DOE \$13,700,000

Non-DOE \$13,700,000

Project Description

Through the U.S. Department of Energy's Clean Coal Technology Program, Public Service Company of Colorado is combining innovative technologies to reduce air pollutants that lower urban air quality and contribute to acid rain.

The Colorado utility is using a coal-fired boiler at its Arapahoe Station in Denver to test a combination of advanced, low-cost pollution-control techniques. Together, these devices are significantly reducing the sulfur dioxide (SO₂) and nitrogen oxides (NOx) emitted by the coal-fired power plant.

The project marks the first time specially designed low-NOx burners have been tested on a down-fired boiler, a type of boiler designed with burners mounted on its roof. These compact boilers tend to be high-NOx emitters.

In another first-of-a-kind demonstration, a mixture of urea and water is sprayed into the coal furnace, forming harmless nitrogen, water, and carbon dioxide while further reducing NOx. SO₂ is reduced by injecting sulfur-absorbing calcium- or sodium-based materials into the boiler outlet duct. A fine mist of water is also sprayed into the flue gas during calcium injection to aid in capturing SO₂.

In tests to date, the technologies have reduced NOx by up to 80%, a reduction once thought achievable only with more expensive and chemically complex catalytic processes. SO₂ emissions have been reduced by 70%. Testing is being conducted on western bituminous coal, which is the main fuel used. A short evaluation using subbituminous coal was also conducted.

Program Goal

Coal represents 94% of proven U.S. fossil fuel reserves and 70% of the world's proven fossil fuel reserves. When used for power generation, however, coal produces harmful SOx, NOx, (associated with acid rain) and CO₂ emissions, which new technology can reduce significantly.

This demonstration shows that for certain fuel types, innovative combinations of technologies can effect sharply reduced levels of NOx and SO₂ at lower capital cost.



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CONTACT POINTS

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Project Partners

ELECTRIC POWER RESEARCH INSTITUTE

Palo Alto, CA
(cofunding)

COLORADO SCHOOL OF MINES

Golden, CO
(injection testing)

STONE & WEBSTER ENGINEERING CORP.

Denver, CO
(engineering)

BABCOCK & WILCOX

Alliance, OH
(burner developer)

WESTERN RESEARCH INSTITUTE

Laramie, WY
(flyash evaluator)

NOELL INC.

Long Beach, CA
(urea injection system)

FOSSIL ENERGY RESEARCH CORP.

Laguna Hills, CA
(operational testing)

COASTAL CHEM.

Salt Lake City, UT
(urea supplier)

Project Benefits

The first combination of advanced technologies being demonstrated at Public Service Company of Colorado's Arapahoe Station is bringing the environmental and economic benefits of advanced technology to Denver while serving as a showcase for utilities throughout the Nation.

The acid rain provisions of the 1990 Clean Air Act Amendments require coal-fired utilities throughout the Nation to reduce emissions of both SO₂ and NO_x emissions, starting in 1995 or 2000.

Also, NO_x emissions have been linked to urban smog and impaired visibility in areas near National Parks. NO_x emissions have been a major concern in Denver and surrounding regions in Colorado for several years.

Tests at the Arapahoe Station are showing how these emissions can be reduced without major increases to residential utility bills. The 100-megawatt Arapahoe boiler has been retrofitted with a combination of advanced pollution-control techniques that is sharply reducing emissions of both SO₂ and NO_x.

The demonstrated technologies offer a number of advantages:

- NO_x and SO₂ emissions from existing coal-fired boilers can be reduced by up to 80% and 70%, respectively.
- Additional environmental benefits include minimal solid-waste-disposal concerns, low water requirements, and no additional production of wastewater.
- The technologies, either alone or in combination, can be used with the full range of both new and retrofit applications.
- Space requirements are relatively modest, as is the boiler downtime required for installation.
- The technologies can be effective with a wide range of coals.

If the technologies being demonstrated at the Arapahoe Station can effectively reduce both SO₂ and NO_x emissions while maintaining low operating and maintenance costs, then the Nation's utilities have effective options for providing clean, economical power from coal.

Cost Profile (Dollars in Millions)

| | Prior Investment | FY95 | FY96 | FY97 | Future Funds |
|-------------------------|------------------|-------|------|------|--------------|
| Department of Energy * | \$12 | \$0.7 | \$1 | — | — |
| Private Sector Partners | \$12 | \$0.7 | \$1 | — | — |

* Appropriated Funding

Key Milestones

| FY90 | FY91 | FY92 | FY93 | FY94 | FY95 | FY96 |
|-----------------------|-----------|-------------------------|-----------------------------|--|------|-------------------|
| | Pre-award | Design and Construction | Construction | Operation | | |
| Design initiated 6/90 | | Ground-breaking 5/21/91 | Construction completed 8/92 | Powder River Basin coal test completed 11/95 | | |
| | | | | | 3/96 | Final Report 7/96 |